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Attn: Patent Application Branch

RE: Filing of Patent Application  
**"EXPRESS MAIL" LABEL NUMBER: EL175652414US**  
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Dear Sir:


Enclosed for filing is a patent application of Toshihiko Suzuki, Hidenori Hoshi and Hiroaki Endo for an APPARATUS FOR RECORDING SIGNALS ON DISK RECORDING MEDIUM, the application comprising a Specification of 48 pages; 25 numbered Claims, including six Independent numbered Claims; 20 sheets of Formal Drawings (Figures 1-22); an Abstract and our check in the amount of \$1,014.00 in payment of the filing fee, which has been calculated as follows: \$690.00 base filing fee, \$234.00 for three Independent claims in excess of three and \$90.00 for five claims in excess of twenty.

A "Combined Declaration and Power of Attorney for Patent Application" will be filed at a later date.

Claim will be made under 35 U.S.C. § 119 for the benefit of the filing date of Japanese Patent Application Nos. 11-234287 (filed August 20, 1999); 11-257628 (filed September 10, 1999); 11-304137 (filed October 26, 1999) and 11-350467 (filed December 9, 1999) certified copies of which will be filed in due course.

Authorization is given for the charging of any further fee for effecting filing to our Deposit Account No.18-1644.

Respectfully submitted,

  
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Apparatus for Recording Signals on  
Disk Recording Medium

## BACKGROUND OF THE INVENTION

## 5 Field of the Invention

The present invention relates to an apparatus for recording signals such as image signals on a disk recording medium and, more particularly, to control of management information of recorded signals.

## 10 Related Background Art

Conventionally, a video tape recorder which records analog video signals on magnetic tapes is available as an image recording apparatus for recording video signals on a recording medium. However, with rapid progress of digital signal processing technologies, digital recording/playback apparatuses which record analog video signals on a recording medium by converting the signals into digital video signals are becoming popular at present.

20 Such digital recording/playback apparatuses include a digital VTR, a digital video disk apparatus which records signals on a solid-state disk or magneto-optical disk, and a solid-state memory video apparatus which records signals in a solid-state memory  
25 such as a flash memory or an SRAM.

These digital recording/playback apparatuses load a video signal obtained by an image pickup device such

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as a CCD and convert the signal into a digital signal  
by A/D conversion. The apparatuses reduce the  
information amount by compression-encoding this digital  
video signal. In this manner, these apparatuses can  
5 record a large amount of image information in a small  
recording capacity.

Schemes used as this compression encoding are  
discrete cosine transform (to be referred to as DCT  
hereinafter) which is orthogonal transformation having  
10 the highest compression efficiency, and a  
variable-length coding scheme. To perform compression  
encoding, a single image is first segmented into a  
plurality of blocks each having  $x$  horizontal pixels and  
 $y$  vertical pixels, and DCT transform is performed for  
15 each block. A DCT coefficient after the transform is  
divided by a certain divisor, and the remainder is  
rounded, thereby performing quantization. By using the  
characteristic that a quantized image is concentrated  
in low-frequency components, the number of bits of  
20 high-frequency components is reduced. In this way, the  
information amount is greatly reduced.

The information amount can be further compressed  
by performing variable-length encoding, e.g., Huffman  
coding, which assigns to the quantized data a code  
25 length corresponding to the occurrence frequency of the  
data.

Furthermore, greater compression can be attained

by combining interframe predictive encoding which calculates the difference between frames, by using the characteristic that a motion image has a strong correlation between frames.

5           Of this type of recording/playback apparatuses,  
the capacities of disk media of disk apparatuses are  
rapidly increasing in recent years. Consequently,  
apparatuses which record and play not only audio  
signals but video signals in and from a disk medium for  
10 a long time have been proposed. For example, a  
technique has been proposed which uses a recording  
format based on high-efficiency encoding such as MPEG  
using, e.g., DCT and variable-length encoding described  
above, and which can realize a recording/playback  
15 apparatus which records video signals for one hour or  
more at data rates of about 4 Mbps and 10 Mbps.  
Furthermore, disk media themselves are being reliably  
decreased in size and increased in capacity.

In an image recording apparatus which records  
20 video signals on a disk medium by reducing the  
information amount by compressing the signals by  
combining the aforementioned compression techniques,  
the information amount varies in accordance with an  
image because variable-length encoding is used.  
25 Therefore, a rate control means for holding the  
information amount constant is used to uniformize the  
recording rate of images, thereby recording images in a

predetermined recording media capacity within a predetermined time.

5 This rate control uniformizes the rate by writing compressed data having variations into a certain predetermined buffer and reading out the data at a constant rate. That is, buffer control is performed such that if the data may exceed a predetermined value of the buffer, the quantization level described above is increased to raise the compression ratio; if the  
10 buffer does not satisfy the predetermined value, the quantization level is decreased to lower the compression ratio.

15 In constant bit rate recording (CBR recording), the recording rate is held constant by giving priority to the target time of recording on a recording medium. Hence, if an input image moves fast or has a wide color band, quantization becomes coarse to make the image nonuniform between frames. Therefore, an image recording apparatus which performs variable bit rate  
20 recording (VBR recording) by attaching importance to image quality has been proposed. This VBR recording performs encoding giving priority to image quality by holding the quantization level of recording at a substantially constant value, while allowing  
25 fluctuations of the recording rate.

A recording/playback apparatus like this uses management information called Table of Contents (to be

referred to as a TOC hereinafter) to control video data recording and playback operations. When video data obtained by image pickup is recorded on a recording medium, the TOC information is recorded in an area  
5 formed on the inner peripheral side of the disk medium independently of an area for recording video data. In playback operation, the TOC information is read out from the disk medium and held in an internal memory of the apparatus. On the basis of this TOC information,  
10 the position of access to the disk medium and diverse operations such as video data playback management are controlled.

Examples of operations managed using the TOC are an operation of linking data of one scene, which are  
15 discontinuously recorded on a recording medium, and continuously displaying back the data, an operation of deleting a scene once obtained by image pickup, and an operation of recording a scene newly obtained by image pickup in a free space formed by deletion.

20 In any of these operations, video data is recorded in an area (video recording area) formed near the center in the radial direction of a disk medium, and the TOC information is saved in an area (system information management area) formed inside the image  
25 recording area. Note that no data can be recorded in the outer periphery of the disk.

Since the TOC is important information necessary

to recording/playback, the reliability is improved by, e.g., recording the TOC a plurality of times in the system management area of a disk.

5 In conventional image pickup recording/playback apparatuses, the TOC is recorded on a disk after video data is completely written in the medium. That is, after the recording end pointer (address) of video data on a disk is determined, various pieces of information including an end pointer and start pointer are recorded  
10 as the TOC information.

If, therefore, one recorded scene extends over a long time period, no TOC information may be recorded for long periods of time.

Also, a system using a disk medium can rapidly  
15 access data in the disk medium, so recording or playback access to the disk medium is usually intermittently performed. Between this disk access operation and other operations, large differences are produced in consumption power such as motor driving  
20 power, head driving power, and write laser power.

When a series of recording operations are performed with battery driving, therefore, the battery supply voltage lowers with an abrupt rise of the consumption power upon disk access. This sometimes  
25 makes the recording operations of the system impossible to perform.

Especially when the TOC information is to be

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recorded, the write operation is performed by moving a recording/playback head mechanism from the video recording area for recording video data to the system management area in a remote position. Hence, if the  
5 battery amount remains to such an extent that a video data recording operation is marginally possible, the TOC information cannot be written in the worst case.

If the TOC information is missing, the start pointer, end pointer, attribution, and the like of  
10 recorded video data are unknown, so disk medium playback control cannot be performed.

Also, even if the reliability of the TOC data is improved as described previously, recording is sometimes abnormally terminated in the middle of a  
15 scene by, e.g., careless handling by a user, running out or abrupt discharge of a battery, a defect of a recording medium, or some external cause. In a case like this, actually recorded images and sounds and additional data sometimes disagree with the contents of  
20 the TOC. This makes playback of the scene based on the TOC impossible.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to solve  
25 the above conventional problems.

It is another object of the present invention to reliably record management information such as TOC

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information on a recording medium without losing the management information, even when the remaining battery amount becomes insufficient during image pickup recording.

5           It is still another object of the present invention to normally reproduce a recorded signal halfway even when recording of the signal is not normally completed.

10           To achieve the above objects, according to one aspect of the present invention, there is provided a recording apparatus comprising reproducing means for reproducing management information pertaining to a recording address of an image signal from a disk-like recording medium having a first area for the image  
15           signal and a second area for the management information, control means for detecting the state of the reproduced management information by using the management information and, on the basis of the detection result, controlling the reproducing means to  
20           reproduce management data from the first area of the disk-like recording medium, modifying means for modifying the management information reproduced from the second area, on the basis of the management data reproduced from the first area, and recording means for  
25           recording an image signal in the first area of the disk-like recording medium and recording the management information modified by the modifying means in the

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second area.

Other objects and features of the present invention will become apparent from the following detailed description of embodiments of the invention taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the configuration of a recording apparatus according to an embodiment of the present invention;

Fig. 2 is a block diagram showing the arrangement of a recording unit shown in Fig. 1;

Fig. 3 is a view showing the directory structure of the apparatus shown in Fig. 1;

Fig. 4 is a view showing a TOC processed by the apparatus shown in Fig. 1;

Fig. 5 is a view showing the major components of an electric power unit of the apparatus shown in Fig. 1;

Fig. 6 is a flow chart for explaining an operation of the apparatus shown in Fig. 1;

Fig. 7 is a view showing another example of the TOC processed by the apparatus shown in Fig. 1;

Fig. 8 is a flow chart for explaining another operation of the apparatus shown in Fig. 1;

Fig. 9 is a view showing a recording format on a disk in the apparatus shown in Fig. 1;

5 rearrangement by the apparatus shown in Fig. 10;

Fig. 13 is a timing chart showing the recording timings of TOC data in the apparatus shown in Fig. 1;

Fig. 14 is a timing chart showing the recording timings of an image signal in the apparatus shown in Fig. 10;

Figs. 15A and 15B are graphs showing a picture  
change detection process by the apparatus shown in  
15 Fig. 14;

Fig. 16 is a block diagram showing the configuration of a recording apparatus according to still another embodiment of the present invention;

Fig. 17 is a graph for explaining the operation of  
an audio change detection circuit of the apparatus  
shown in Fig. 16;

Fig. 18 is a timing chart showing the recording timings of TOC data in the apparatus shown in Fig. 16;

Fig. 19 is a block diagram showing the  
25 configuration of a recording apparatus according to  
still another embodiment of the present invention;

Fig. 20 is a view showing a recording format on a

disk in the apparatus shown in Fig. 19;

Fig. 21 is a view showing recorded data on the disk shown in Fig. 20; and

Fig. 22 is a view showing TOC data processed by  
5 the apparatus shown in Fig. 21.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described in detail below with reference to the  
10 accompanying drawings.

Fig. 1 is a block diagram showing the configuration of a recording/playback apparatus 100 according to the first embodiment of the present invention. Referring to Fig. 1, this  
15 recording/playback apparatus 100 comprises an optical system 101 including, e.g., a lens and a lens controller, an image pickup processing unit 102, an A/D converter 103, a camera signal processing unit 104, a video signal processing unit 105, a D/A converter 106,  
20 an analog video signal output unit 107, a display unit 108, a data bus 109, a memory 110, a memory controller 111, a CPU 112, a disk unit 113, an electric power unit 114 such as a battery, and an operation unit 115 including, e.g., a power switch and a recording trigger  
25 switch. For the sake of simplicity, the electric power unit 114 is connected only to the CPU 112 in Fig. 1. In reality, however, electric power is supplied to all

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units requiring power via power lines.

In this recording/playback apparatus 100, the optical system 101 including a lens performs iris control, focusing control, zoom control, and the like. The image pickup processing unit 102 photoelectrically converts an object image (not shown) by a CCD (Charge-Coupled Device) or the like. The A/D converter 103 converts the obtained analog image signal into a digital signal. The camera signal processing unit 104 performs predetermined data processing such as gamma correction and white balance adjustment for the digital image data.

In recording operation, the video signal processing unit 105 segments the output image data from the camera signal processing unit 104 into a plurality of blocks each composed of a plurality of pixels, performs orthogonal transformation such as DCT for each block, and quantizes and encodes the blocks. Generally, a change between two continuous frames is small in motion image data, so an image of interest has high correlations with images before and after that image. By using this characteristic, the differences between an image of interest and images of frames before and after the image of interest are encoded to perform image compression. An MPEG scheme is used most frequently by which the difference between images is obtained after motion compensation is performed to

reduce the redundancy in the time axis, and orthogonal transformation such as DCT and variable-length coding are performed on the obtained differential data.

5 The image data compressed and encoded by the video signal processing unit 105 is output to the disk unit 113 and recorded on a magnetooptical disk, as will be described later.

10 In playback operation, image data reproduced by the disk unit 113 is output to the video signal processing unit 105. The video signal processing unit 105 performs decoding, which is the reverse of encoding performed during recording, for the reproduced image data to expand its information amount, and outputs the decoded data to the D/A converter 106.

15 The D/A converter 106 converts the output digital video signal from the video signal processing unit 105 into an analog signal. The video signal output unit 107 converts this analog signal into a signal following a television system, such as NTSC or PAL, and outputs  
20 the signal. The display unit 108 is, e.g., a viewfinder or a liquid crystal monitor and allows a user to monitor an image currently being picked up, or a reproduced image, on the basis of the output analog video signal from the D/A converter 106.

25 The CPU 112 controls the operation of the whole recording/playback apparatus 100 via the data bus 109. The CPU 112 also controls parameters in the image

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pickup processing unit 102, the camera signal processing unit 104, and the video signal processing unit 105. The memory control unit 111 controls data write to and read from the memory 110 in accordance with a control signal from the CPU 112.

The arrangement of the disk unit 113 will be described below with reference to Fig. 2.

Fig. 2 is a block diagram showing the arrangement of the disk unit 113.

Referring to Fig. 2, this disk unit 113 includes a magnetooptical disk 201, a magnetic head 202, a driver 203 of the magnetic head, an optical pickup 214, and a preamplifier 205.

A disk motor 208 rotates the disk 201. A thread mechanism 210 moves the magnetic head 202 and the optical pickup 214 in the radial direction of the disk.

In recording operation, this optical pickup 214 irradiates the disk 201 with a laser beam emitted from a semiconductor laser element (not shown) such as a laser diode. At the same time, an encoder 204 performs error correction encoding and channel encoding such as digital modulation for video data input via an interface 207. The driver 203 drives the magnetic head 202 with a driving signal modulated on the basis of the data processed by the encoder 204. In accordance with this modulated driving signal, the magnetic head 202 records the data by performing magnetic field

modulation on the disk 201.

In playback operation, the pickup 214 irradiates the disk 201 with a laser beam emitted from the semiconductor laser element (not shown), detects the polarized light amount of reflected light caused by the magnetic Kerr effect, and supplies the detected amount to the preamplifier 205. The output signal from the preamplifier 205 is subjected to demodulation and error correction decoding by a decoder 206, and output to the video signal processing unit 105 shown in Fig. 1 via the interface 207.

A DC motor 211 drives the thread mechanism 210. A servo digital signal processor (DSP) 213 controls the rotational speed of the disk and servo operations of the thread mechanism 210 by using a motor driver 209 and a servo driver 212. More specifically, the servo DSP 213 controls, e.g., rotational servo of the disk and focusing servo, tracking servo, and seek servo of the pickup system.

The bus I/F 207 exchanges recording/playback data with the data bus 109 shown in Fig. 1. That is, the bus I/F 207 controls input and output of data with respect to the encoder 204 during recording and controls input and output of data with respect to the decoder 206 during playback.

A file (TOC data) structure used in this embodiment will be described below.



First, TOC data processing by the CPU 112 will be explained.

In this embodiment, as shown in Fig. 9, an inner peripheral portion 901 of a disk is used as a system management area, and TOC data is recorded in this system management area 901. Video and audio data are recorded in a video recording area 902.

The CPU 112 writes TOC data, which is read out from a disk by the disk unit 113, into the memory 110 via the memory control unit 111. In this state, the CPU 112 updates the TOC data stored in the memory 110 in accordance with a recording or playback operation. When recording is stopped by the recording trigger switch or when the disk is to be ejected, the CPU 112 records the TOC data in the system management area 901.

Fig. 3 shows the file directory structure of the recording/playback apparatus 100. Referring to Fig. 3, a disk medium 301 is defined as uppermost hierarchy 0. In lower hierarchy 1, application attributions such as video 302, audio 303, a still image 304,..., can be classified. In lower hierarchy 2 of any file (in Fig. 3, the video 302) defined in hierarchy 1, video A 305, video B 306, video C 307,..., can be classified in accordance with the dates of image pickup. Subsequently, in lower hierarchy 3 of any file (in Fig. 3, the video A 305) defined in hierarchy 2, scene 1 (308), scene 2 (309), scene 3 (310),..., partitioned

by ON/OFF of the trigger pointer can be classified.  
Furthermore, in lower hierarchy 4 of any file (in  
Fig. 3, scene 1 (308)) defined in hierarchy 3, an image  
pickup start pointer 311 (address information), an  
5 image pickup end pointer 312 (address information), a  
link pointer 313 (address information) which allows  
jump during editing and playback,..., of scene 1 can be  
classified.

Details of the TOC of the recording/playback  
10 apparatus 100 having this directory structure are shown  
in Fig. 4. Fig. 4 depicts the structure of the TOC.  
This structure is roughly classified into a TOC  
identification header portion containing all 0s or all  
1s, system information, and a management information  
15 table portion. For each item, a start pointer 401, an  
attribution 402, an end pointer 403, and a link pointer  
404 can be defined in units of a few bytes.

As an example, playback control of a file in  
directory hierarchy 3 shown in Fig. 3 will be explained  
20 with reference to Fig. 4.

First, playback is started from the address,  
indicated by a start pointer A of address 0001 in the  
management information table portion, of the video  
recording area on a disk medium. After the recorded  
25 data is continuously reproduced to an address indicated  
by an end pointer B, the operation jumps to address  
AAAA indicated by a link pointer. Subsequently,



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112 checks for the U flag of the TOC stored in the memory 111. In this embodiment, if the U flag is "0", this indicates that the TOC is normally recorded in the system management area 901 of the disk 201 when the last image data is recorded; if the U flag is "1", this indicates that the TOC is not normally recorded in the system management area 901 of the disk 201 when the last image data is recorded.

If the U flag is "0" in step S602, the CPU 112 waits for a processing instruction in steps S603 and S604. If the processing instruction is other than the start of recording, the CPU 112 performs corresponding processing in step S605.

If the instruction is the start of recording, in step S606 the CPU 112 sets the U flag of the TOC data stored in the memory 111 to "1" which indicates that the TOC has not been updated, and causes the disk unit 113 to record the TOC data having this U flag "1" in the system management area 901 of the disk 201. After that, the CPU 112 performs recording processing in step S607 and at the same time always checks for the result of monitoring by the power reduction detector of the electric power unit 114 in step S608.

If the CPU 112 detects in step S608 that the battery power lowers and the voltage is below the predetermined voltage Th1, the flow advances to step S612, and the CPU 112 stops recording the image. In

accordance with this recording stop position, in step S613 the CPU 112 updates the contents of the TOC data stored in the memory 111, so as to reflect the recording start pointer, end pointer, and link pointer of the image data currently being recorded, thereby urgently removing the TOC information.

In step S613, unlike normal recording processing of TOC data, the TOC data is written following the trailing end of the image data whose recording into the video information recording area 902 is stopped, without moving the head mechanism of the disk unit 113 to the system management area 901. After performing this TOC data recording processing in step S613, the CPU 112 waits for the next instruction.

On the other hand, if the battery power is not low in step S608 and a recording stop instruction is detected in step S609, in step S610 the CPU 112 updates the contents of the TOC data stored in the memory 111, so as to reflect the start pointer, end pointer, and link pointer of the latest recorded image data, and sets the U flag to "0". In step S611, the CPU 112 moves the head mechanism to the system management area 901 and writes the TOC information having the updated contents and the U flag "0" in this system management area 901.

If in step S602 the U flag is set to "1" indicating that the TOC does not show the latest



same configuration as the image pickup recording/playback apparatus explained with reference to Figs. 1, 2, and 5 in the first embodiment, so a detailed description thereof will be omitted.

5           In the second embodiment, a TOC is constructed as shown in Fig. 7. One-bit remove information indicating that this TOC information is not normally recorded and its contents do not reflect the latest recorded contents can be described in the MSBs of attribution data 402' in a management information table portion.

10           Processing by a CPU 112 in this embodiment will be described below with reference to a flow chart in Fig. 8.

15           First, after power-on in step S801, the CPU 112 causes a disk unit 113 to read out TOC data from a system management area 901 on a disk 201 and write the TOC data in a memory 111. In step S802, the CPU 112 checks for all MSBs in the attributions 402' of the TOC stored in the memory 111. In this embodiment, if the MSB of the attribution 402' is "0", this indicates that the TOC is normally recorded in the system management area 901 of the disk 201 when the last image data is recorded; if the MSB is "1", this indicates that the TOC is not normally recorded in the system management area 901 of the disk 201 when the last image data is recorded and that the contents of this TOC do not correspond to the latest recorded contents.



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5 If the MSB of the attribution 402' is "0" in step S802, the CPU 112 waits for a processing instruction in steps S803 and S804. If the processing instruction is other than the start of recording, the CPU 112 performs corresponding processing in step S805.

10 If the instruction is the start of recording, in step S806 the CPU 112 sets the MSB of the attribution 402' of the TOC data stored in the memory 111 to "1" which indicates that the TOC has not been updated, and causes the disk unit 113 to record the TOC data having this MSB "1" of the attribution 402' in the system management area 901 of the disk 201. After that, the CPU 112 performs recording processing in step S807 and at the same time always checks for the result of  
15 monitoring by a power reduction detector of an electric power unit 114 in step S808.

20 If in step S808 the CPU 112 detects the battery supply limit, i.e., detects that the battery voltage is below a predetermined voltage Th1, the flow advances to step S812, and the CPU 112 stops recording the image. In accordance with this recording stop position, in step S813 the CPU 112 updates the contents of the TOC data stored in the memory 111, so as to reflect the recording start pointer, end pointer, and link pointer  
25 of the image data currently being recorded, thereby urgently removing the TOC information.

In step S813, unlike normal recording processing

of TOC data, the TOC data is written following the trailing end of the image data whose recording into a video information recording area 902 is stopped, without moving a head mechanism of the disk unit 113 to the system management area 901. After performing this TOC data recording processing in step S813, the CPU 112 waits for the next instruction.

On the other hand, if the battery power is not low in step S808 and a recording stop instruction is detected in step S809, in step S810 the CPU 112 updates the contents of the TOC data stored in the memory 111, so as to reflect the start pointer, end pointer, and link pointer of the latest recorded image data, and sets the MSB of the attribution 402' to "0". In step S811, the CPU 112 moves the head mechanism to the system management area 901 and writes the updated TOC information in this system management area 901.

If in step S802 the MSB of the attribution 402' is set to "1" indicating that the TOC does not show the latest contents, the flow advances to step S814.

In this case, the TOC recorded in the system management area 901 has not been updated to the latest information. Therefore, the CPU 112 sequentially searches the video recording area 902 of the disk 201 from a position indicated by the final end pointer of the newest TOC information recorded in the system management area 901, and reads out the latest TOC

information recorded in the video information recording  
area 902 as described above. In step S815, on the  
basis of the readout latest TOC information, the CPU  
112 updates the contents of the TOC information stored  
5 in the memory 111 and sets the MSB of the attribution  
402' to "0". In step S816, the CPU 112 records this  
TOC information in the system management area 901 which  
is the original recording area of TOC information.

The CPU 112 continues the above operation until  
10 power-off or until the battery voltage becomes lower  
than Th2 and then a comparator 509 shown in Fig. 5  
outputs a signal indicating a power-supply voltage  
drop.

In this embodiment as described above, even when  
15 the battery voltage lowers during recording, TOC  
information reflecting the latest recorded contents can  
be reliably recorded and reproduced.

In the first and second embodiments, the present  
invention is applied to the recording/playback  
20 apparatus 100. However, the present invention is  
similarly applicable to any apparatus which separately  
records main information and its management information  
in separated areas on a recording medium.

The third embodiment of the present invention will  
25 be described below with reference the accompanying  
drawings.

Fig. 10 is a block diagram showing a recording

apparatus 1000 according to this embodiment of the present invention.

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This recording apparatus 1000 comprises an image pickup unit 1001, a picture rearrangement circuit 1002, a switch 1003, a subtractor 1004, a DCT (Discrete Cosine Transform) circuit 1005, a quantization circuit 1006, a variable-length encoding circuit 1007, an inverse quantization circuit 1008, an IDCT (Inverse Discrete Cosine Transform) circuit 1009, an adder 1010, a motion compensation prediction circuit 1011, a switch 1012, a buffer 1013, a rate control circuit 1014, a recording processing circuit 1015, a magnetooptical disk 1016, a picture change detection circuit 1017, a TOC memory 1018 for storing TOC information, a TOC control circuit 1019, and an operation unit 1020 which includes, e.g., a power switch and a recording trigger switch.

The operation will be described next.

A digital image signal obtained by the image pickup unit 1001 is input in units of frames to the picture rearrangement circuit 1002. This picture rearrangement circuit 1002 has a memory capable of storing a digital image signal having a plurality of frames. By using this memory, the picture rearrangement circuit 1002 rearranges frames of the input image signal and outputs the signal.

The operation of the picture rearrangement circuit

1002 will be explained below with reference to Fig. 11.

Referring to Fig. 11, an image signal input in units of frames in the order of a first frame, second frame, third frame,..., is output by rearranging these frames in the order of the third frame, first frame, second frame,...

The picture rearrangement process shown in Fig. 11 is necessary to perform intra-encoding and inter-encoding for an image signal as shown in Fig. 12.

The intra-encoding is a method of encoding using only data in one frame and generates an I picture shown in Fig. 12. The inter-encoding is a method of encoding also using interframe prediction and generates P and B pictures shown in Fig. 12.

The intra-encoding and inter-encoding will be described next.

To perform the intra-encoding, the switch 1003 is closed to a terminal A. The output image data from the picture rearrangement circuit 1002 is input to the DCT circuit 1005 via the switch 1003 and orthogonally transformed. The quantization circuit 1006 quantizes the orthogonally transformed image data in accordance with a quantization coefficient determined by the rate control circuit 1014. The quantized image data is input to the inverse quantization circuit 1008 and the variable-length encoding circuit 1007.

The output image data from the picture

rearrangement circuit 1002 is also input to the motion compensation prediction circuit 1011 and the picture change detection circuit 1017.

5 The quantized data is inversely quantized by the inverse quantization circuit 1008 and subjected to IDCT by the IDCT circuit 1009. The switch 1012 is turned off to supply the image data subjected to IDCT to the motion compensation prediction circuit 1011. The motion compensation prediction circuit 1011 generates and outputs a predictive image for the subsequent inter-encoding.

10 The quantized data is also input to the variable-length encoding circuit 1007 where the data is variable-length-encoded. The encoded data is input to the buffer 1013. When reaching a certain predetermined data amount, the image data in the buffer 1013 is output to the recording processing circuit 1015. This recording processing circuit 1015 has an arrangement as shown in Fig. 2 and records the data on the magnetooptical disk 1016. The recording processing circuit 1015 can record data at a higher data rate than the rate of image data input to the buffer 1013. In practice, the recording processing circuit 1015 intermittently reads out data in units of predetermined amounts of data from the buffer 1013 and records the readout data.

To perform the inter-encoding, the switch 1003 is

closed to a terminal B. The subtractor 1004 is used to lower the redundancy in the time axis. This subtractor 1004 outputs the difference between the output image data from the picture rearrangement circuit 1002 and the predictive image data from the motion compensation prediction circuit 1011 to the terminal B of the switch 1003.

The output data from the subtractor 1004 is input to the DCT circuit 1005 via the switch 1003 and orthogonally transformed. The quantization circuit 1006 quantizes the orthogonally transformed image data in accordance with a quantization coefficient determined by the rate control circuit 1014. The quantized image data is input to the inverse quantization circuit 1008 and the variable-length encoding circuit 1007.

The output image data from the picture rearrangement circuit 1002 is also input to the motion compensation prediction circuit 1011 and the picture change detection circuit 1017.

The quantized data is inversely quantized by the inverse quantization circuit 1008 and subjected to IDCT by the IDCT circuit 1009. In this inter-encoding, the switch 114 is turned on to allow the adder 1010 to add the image data from the IDCT circuit 1009 and the predictive image data from the motion compensation prediction circuit 1011, thereby obtaining decoded

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image data. This decoded image data is input to the motion compensation prediction circuit 1011 for the subsequent image encoding. The motion compensation prediction circuit 1011 outputs predictive image data and a motion vector. This motion vector is input to the variable-length encoding circuit 1007.

The quantized data is input to the variable-length encoding circuit 1007 where the data is variable-length-encoded. The encoded data is input to the buffer 1013. When reaching a certain predetermined data amount, the image data in the buffer 1013 is output to the recording processing circuit 1015. The recording processing circuit 1015 records the image data on the disk 1016.

Recording of a TOC as index information in this embodiment will be described below.

Also in this embodiment, TOC information is recorded in a system management area 901 on a disk shown in Fig. 9.

When the power supply is turned on by the operation unit 1020, the TOC control circuit 1019 stores TOC information, read out from the system management area on the disk 1016 by the recording processing circuit 1015, in the TOC memory 1018. In accordance with recording processing, the TOC control circuit 1019 updates the contents of the TOC information stored in the TOC memory 1018. When the



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Figs. 13 and 14 are views for explaining TOC recording timings.

Symbols ★ in Fig. 13 indicate timings at which the picture change detection circuit 1017 detects a large picture change.

Referring to Fig. 13, in scene 1, TOC information is recorded in the system management area at the timings of detection of picture change 1301, temporary stop 1302, and stop of recording 1303.

As described earlier, image data is output to the recording processing circuit 1015 via the buffer 1013. Also, the recording processing circuit 1015 can record data on the disk 1016 at a higher rate than the data rate of image data input to the buffer 1013.

That is, the recording processing circuit 1015 performs intermittent recording on the disk 1016. As shown in Fig. 14, therefore, non-record periods are produced during recording of image data. Fig. 14 shows recording periods 1401 and data non-record periods 1402. Accordingly, when a picture change is detected at timing 1401a, TOC information can be recorded, even during image data recording, by moving the head to the system management area in a data non-record period 1402a.

Also, in scene 1 of Fig. 13, recording is normally stopped at timing 1303. Hence, TOC information reflecting data recorded up to this stop of recording

1303 is recorded in the disk 1016. So, all recorded data up to 1303 can be correctly reproduced.

5 In scene 2, TOC information is recorded in the system management area at picture change detection timings 1304 and 1305. In this example, the power supply is shut down at timing 1306 before recording stop operation, so recording is not normally stopped. However, TOC information is recorded on the disk 1016 at the timing 1305 at which a picture change is  
10 detected. The TOC information recorded at this timing 1305 reflects the contents of image data recorded up to 1305. In playback, therefore, data from the start of recording of scene 2 to the timing 1305 at which a picture change is lastly detected can be correctly  
15 reproduced.

In this embodiment, a picture change is detected by the difference between frames. However, a picture change can also be detected by another method.

For example, as shown in Figs. 15A and 15B, a  
20 histogram of the directions of motion vectors calculated by the motion compensation prediction circuit 113 is obtained in one frame. If the correlation between the motion vectors in one frame is low, a picture change is detected.

25 Referring to Fig. 15A, motion vectors having angles of 0 to 90° is largest in number, so changes between pictures are obviously small. Referring to



the encoded image data to the buffer 1024. The multiplexer 1025 multiplexes the image data stored in the buffer 1013 and the audio data stored in the buffer 1024 such that pictures and audio are synchronized.

5 The multiplexed data is output to the recording processing circuit 1015.

Recording of a TOC as an important point of the present invention will be described next.

Also in this embodiment, TOC information is  
10 recorded in a system management area 901 on a disk shown in Fig. 9.

When the power supply is turned on by an operation unit 1020, a TOC control circuit 1019 stores TOC information read out from the system management area on  
15 a disk 1016 by the recording processing circuit 1015, in a TOC memory 1018. In accordance with recording processing, the TOC control circuit 1019 updates the contents of the TOC information stored in the TOC memory 1018. When the stop of recording is designated  
20 by the operation unit 1020, the TOC control circuit 1019 reads out the newest TOC information stored in the TOC memory 1018. The recording processing circuit 1015 records the readout TOC information in the system management area of the disk 1016.

25 In this embodiment, the TOC control circuit 1019 further records the TOC information stored in the TOC memory 1018 into the disk 1016 in accordance with an

output from the audio change detection circuit 1022.

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This audio change detection circuit 1022 has a  
comparator and, as shown in Fig. 17, outputs a  
high-level signal to the TOC control circuit 1019 when  
5 a period during which the level of an input audio  
signal is lower than a predetermined threshold  $A_{th}$   
continues for a predetermined time  $T_{th}$  or more. When  
the audio change detection circuit 1022 outputs this  
high-level control signal, the TOC control circuit 1019  
10 controls the TOC memory 1018 to record TOC information  
which reflects the contents of recording up to the  
point, in the system management area of the disk 1016  
by the recording processing circuit 1015, by using a  
period during which neither image data nor audio data  
15 are recorded.

Fig. 18 is a view for explaining TOC recording  
timings.

Symbols ★ in Fig. 18 indicate timings at which the  
audio change detection circuit 1022 outputs a control  
20 signal indicating that a period in which the input  
audio level is lower than the threshold value is  
detected. In scene 1, TOC information is recorded in  
the system management area 901 of the disk 1016 at the  
timings of audio change detection 1801, temporary stop  
25 1802, and stop of recording 1803.

Also in this embodiment, image data is output to  
the recording processing circuit 1015 via a buffer

1013. Also, the recording processing circuit 1015 can record data on the disk 1016 at a higher rate than the data rate of image data input to the buffer 1013.

That is, the recording processing circuit 1015  
5 performs intermittent recording on the disk 1016. As shown in Fig. 14, therefore, non-record periods are produced during recording of image data. Fig. 14 shows recording periods 1401 and data non-record periods 1402. Accordingly, when a picture change is detected  
10 at timing 1401a, TOC information can be recorded, even during image data recording, by moving the head to the system management area 901 in a data non-record period 1402a.

Also, in scene 1 of Fig. 18, recording is normally  
15 stopped at timing 1803. Hence, TOC information reflecting data recorded up to this stop of recording 1803 is recorded in the disk 1016. So, all recorded data up to 1803 can be correctly reproduced.

In scene 2, TOC information can be recorded in the  
20 system management area on the disk 1016 at audio change detection timings 1804 and 1805. In this example, the power supply is shut down at timing 1806 before recording stop operation, so recording is not normally stopped.

25 In this embodiment, however, TOC information reflecting the contents of recording up to the point is recorded on the disk 1016 at the timing 1805 at which

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an audio change is detected. Therefore, data from the start of recording of scene 2 to the timing 1805 at which an audio change is lastly detected can be correctly reproduced.

5           The fifth embodiment of the present invention will be described below with reference to the accompanying drawings.

Fig. 19 is a block diagram showing the configuration of a recording apparatus 1000 according to this embodiment. The same reference numerals as in the configurations shown in Figs. 10 and 16 denote the same parts, and a detailed description thereof will be omitted.

10           The recording apparatus of this embodiment further comprises a system control circuit 1026 for controlling the overall operation of the apparatus 1000, a still image encoding circuit 1027, a buffer 1028 for still image signals, and a buffer 1029 for TOC information.

15           Referring to Fig. 19, the system control circuit 1026 controls the operation of each unit of the apparatus. That is, in accordance with instructions from an operation unit 1020, the system control circuit 1026 controls a picture rearrangement circuit 1002, switches 1003 and 1012, and the still image encoding circuit 1027.

20           First, the operation of normal motion image recording will be described below.



When the start of motion image recording is designated by the operation unit 1020, the system control circuit 1026 controls a picture rearrangement circuit 1022 to rearrange frames of an image signal from an image pickup unit 1001 as shown in Fig. 11, and outputs the signal to a switch 1003, a subtractor 1004 and a motion compensation prediction circuit 1011. After that, this motion image signal is encoded as described earlier by, e.g., a DCT circuit 1005, a quantization circuit 1006, a variable-length encoding circuit 1007, an inverse quantization circuit 1008, an IDCT circuit 1009, an adder 1010, and the motion compensation prediction circuit 1011. The encoded signal is output to a buffer 1013.

Also, an input audio signal from an audio input unit 1021 is encoded by an audio encoding circuit 1023 and output to a buffer 1024.

The operation of still image recording will be described next.

The recording apparatus of this embodiment has a still image recording mode. When still image recording is designated by the operation unit 1020 during recording of a motion image signal, a still image signal can be recorded on a disk 1016 independently of the motion image signal.

When the operation unit 1020 designates still image recording, the system control circuit 1026

outputs a control signal to the picture rearrangement circuit 1022 to extract image data of a frame, at the timing corresponding to the still image recording instruction, from an image signal having a plurality of frames output from the image pickup unit 1001. The extracted image signal is output to the still image encoding circuit 1027.

In accordance with a control signal from the system control circuit 1026, the still image encoding circuit 1027 receives the image data of one frame output from the picture rearrangement circuit 1002, encodes the data on the basis of a JPEG standard for still image encoding, and outputs the encoded still image data to the buffer 1028. The encoding scheme of this still image encoding circuit 107 is, of course, not limited to JPEG encoding. For example, base band encoding can also be performed. The still image encoding circuit 1027 performs real-time processing at a rate of, e.g., 4 Mbits/sec.

Under the control of the system control circuit 1026, a multiplexer 1025 time-divisionally multiplexes the motion image signal and audio signal stored in the buffer 1024, the still image signal stored in the buffer 1028, and TOC information stored in the buffer 1029 (as will be described later), and outputs the multiplexed data to a recording processing unit 1015. The recording processing unit 1015 records this

multiplexed data in the magneto-optical disk 1016.

Fig. 20 is a view showing recording areas of TOC data, motion image·audio data, and still image data on the disk 1016 according to this embodiment.

5 Referring to Fig. 20, TOC data is recorded in a TOC recording area 901 in the innermost peripheral portion as in Fig. 9. In this embodiment, a video recording area is divided into a motion image recording area 902A and a still image recording area 902B. That  
10 is, still image data is recorded in the still image recording area 902B outside the TOC recording area 901. Motion image·audio data is recorded in the motion image·audio recording area 902A outside the still image recording area 902B.

15 The still image recording area 902B and the motion image·audio recording area 902A are segmented into sectors toward the outer periphery, and these sectors are assigned sector numbers in order. Each sector is referred to by the start address, end address, and the  
20 like in TOC data.

As shown in Fig. 21, the recording processing circuit 1015 records variable-length motion image data in units of GOP and fixed-length audio data in a time series manner in the motion image recording area 902A  
25 on the disk 1016. In encoding of MPEG2, a plurality of frames between two I pictures are called 1GOP (Group Of Pictures) and used as a unit of encoding. Usually,

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1GOP is composed of 15 frames.

When still image data is stored in the buffer 1028 in response to a still image recording instruction, the system control circuit 1026 controls the multiplexer 1025 to read out this still image data stored in the buffer 1028 by using a period during which recording of motion image data and audio data on the disk 1016 is stopped, i.e., a period 1401 shown in Fig. 14. The readout still image data is recorded in the still image recording area 902B different from the motion image recording area 902A on the disk 1016.

TOC data in this embodiment will be described below.

Fig. 22 is a view showing the contents of TOC data according to this embodiment.

The TOC of this embodiment has a scene table 2201 and a contents table 2202. The scene table 2201 shows the order of scenes and the correspondence between each scene and a row in the contents table 2202. In playback, scenes are usually reproduced in the order in this scene table 2201.

Also, the scene table 2201 can manage 4,095 scenes, and each scene has a 12-bit pointer which indicates a specific row in the contents table 2202. This scene table 2201 is used in order from 1, and a pointer having no corresponding scene has "0" which indicates the end.

The contents table 2202 has 4,095 rows, and each row has a start address 2203, an end address 2204, a link pointer 2205, and an attribution 2206. The start address 2203 and the end address 2204 are composed of 20 bits each and have the start and end addresses, respectively, of a corresponding scene.

The link pointer 2205 has a pointer indicating the row of the continuation of a scene, when a certain scene is connected to another scene to form one scene or when one scene is dispersedly recorded in discontinuous areas owing to the locations of empty areas. As indicated by an arrow in Fig. 22, when the continuation of a scene shown in row 1 of the contents table 2202 is shown in row 3, "3" is stored in the link pointer 2205 of row 1 to hold the continuity of the scene.

The attribution 2206 stores data indicating an attribution such as motion image, still image, or copy inhibition.

Data to be processed is, of course, not restricted to motion image audio data and still image data but can be script data and the like. The type of data can be described in the attribution 2206 of the TOC data.

A summary of updating of TOC data as management information in the present invention will be explained below. Details will be described later.

When the power supply is turned on, only TOC data

is reproduced from the TOC recording area 901 on a recording medium and stored in the TOC memory 1018. The system control circuit 1026 can instantly know which data is stored in which area on the disk 1016 at present by referring to the TOC data loaded into the TOC memory 1018. To record a motion image and a still image, therefore, the system control circuit 1026 so controls as to record new data by designating an empty area on the basis of the TOC.

In this embodiment, whenever the operation unit 1020 designates still image recording, the system control circuit 1026 updates the TOC data stored in the TOC memory 1018 to have contents recorded up to that point, i.e., to have contents reflecting all pieces of information concerning motion image data recorded up to that point and still image data to be recorded henceforth.

The system control circuit 1026 outputs the TOC data having the updated contents to the buffer 1029 and records the still image data, stored in the buffer 1028, into the still image recording area 902B on the disk at the aforementioned timing. Subsequently, the system control circuit 1026 reads out the TOC data stored in the buffer 1029 and records the readout TOC data in the system management area 901 on the disk 1016. Also in this embodiment, whenever the operation unit 1020 designates the start and end of normal motion

image recording, the system control circuit 1026  
updates the contents of the TOC data, supplies the  
updated TOC data from the TOC memory 1018 to the buffer  
1029, and records the TOC data in the system management  
5 area 901 on the disk 1016.

Still image recording can be designated even while  
no motion image is being recorded. Also in this case,  
TOC data is updated and recorded on the disk 1016.

In this embodiment as described above, when  
10 recording of a still image is instructed while a motion  
image is being recorded, TOC data reflecting recorded  
contents is recorded on a disk at that time.

During image pickup of one scene, therefore, even  
when abnormality such as a decrease in remaining  
15 battery amount occurs and recording of a motion image  
is not normally terminated, if still image recording is  
designated at least once while a motion image is being  
picked up, TOC data reflecting recorded contents up to  
that point the still image data is recorded can be  
20 recorded on a disk.

Accordingly, the motion image data, audio data,  
and still image data recorded up to that point can be  
correctly reproduced.

The present invention can be applied to a system  
25 constituted by a plurality of devices or an apparatus  
comprising a single device.

Further, the objects of the present invention can

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also be achieved by supplying a storage medium (or a recording medium) recording program codes of software for realizing the functions of the abovementioned embodiments to a system or an apparatus, and allowing a computer (e.g., a CPU or MPU) of the system or the apparatus to read out and execute the program codes stored in the storage medium. In this case, the program codes themselves read out from the storage medium realize the functions of the above embodiments, and the storage medium storing the program codes constitutes the invention. Furthermore, besides the functions of the above embodiments are realized by executing readout program codes by a computer, the present invention includes a case where an OS (Operating System) or the like running on the computer executes a part or the whole of actual processing on the basis of instructions by the program codes, and the functions of the embodiments are achieved by the processing.

The present invention also includes a case where, after the program codes read out from the storage medium are written in a memory of a function extension board inserted into a computer or of a function extension unit connected to the computer, a CPU or the like of the function extension board or function extension unit performs a part or the whole of actual processing on the basis of instructions by the program



codes, and the functions of the above embodiments are accomplished by the processing.

Many widely different embodiments of the present invention may be constructed without departing from the spirit and scope of the present invention. It should  
5 be understood that the present invention is not limited to the specific embodiments described in the specification, except as defined in the appended claims.

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WHAT IS CLAIMED IS:

1. A recording apparatus comprising:

reproducing means for reproducing management  
information pertaining to a recording address of an  
5 image signal from a disk-like recording medium having a  
first area for the image signal and a second area for  
the management information;

control means for detecting the state of the  
reproduced management information by using the  
10 management information and, on the basis of the  
detection result, controlling said reproducing means to  
reproduce management data from the first area of the  
disk-like recording medium;

modifying means for modifying the management  
15 information reproduced from the second area, on the  
basis of the management data reproduced from the first  
area; and

recording means for recording an image signal in  
the first area of the disk-like recording medium and  
20 recording the management information modified by said  
modifying means in the second area.

2. An apparatus according to claim 1, wherein  
said modifying means updates contents of the management  
25 information in accordance with a recording operation of  
the image signal by said recording means, and the  
management information contains update information

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3. An apparatus according to claim 2, wherein  
said control means detects the state of the management  
information in accordance with the update information.

5. An apparatus according to claim 1, wherein  
said control means so controls said reproducing means  
as to retrieve the management data recorded in the  
first area in accordance with the management  
information reproduced from the second area.

recording means for recording the image signal and  
25 the management information on said disk-like recording  
medium;

storage means for storing the management

information;

updating means for updating contents of the management information stored in said storage means in accordance with a recording operation of the image  
5 signal of said recording means, the management information containing update information indicating an update state of the management information; and

control means for controlling said recording means so as to record the management information containing  
10 the update information indicating a predetermined code in the second area before recording of the image signal is started, and record the management information which contains update information indicating another code and whose contents are updated by said updating means, in  
15 the second area after the recording of the image signal is completed.

7. An apparatus according to claim 6, wherein the predetermined code indicates "not updated", and said  
20 other code indicates "updated".

8. An apparatus according to claim 6, wherein said control means so controls said recording means as to record the management information containing the  
25 update information indicating the predetermined code in the second area in accordance with designation of a start of recording by an operation switch, and record

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the management information which contains update  
information indicating said other code and whose  
contents are updated by said updating means, in the  
second area in accordance with designation of a stop of  
5 recording by the operation switch.

9. An apparatus according to claim 6, further  
comprising:  
power supply means; and  
10 detecting means for detecting electric power from  
said power supply means to output a detection signal  
indicating power reduction, and  
wherein said control means so controls said  
recording means as to record management data concerning  
15 an image signal recorded on said disk-like recording  
medium in the first area in accordance with the  
detection signal from said detecting means during  
recording of the image signal.

20 10. An apparatus according to claim 9, wherein  
said control means checks whether the update  
information contained in management information  
reproduced from the second area is the predetermined  
code and, if the update information is the  
25 predetermined code, so controls said updating means as  
to modify the management information on the basis of  
the management data reproduced from the first area.

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management information stored in said storage means in accordance with a recording operation of the

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recording means for recording the information

signal encoded by said encoding means and the updated management information on the disk-like recording medium;

state detecting means for detecting the state of the input information signal; and

control means for controlling said updating means to update contents of the management information in accordance with an output from said state detecting means, and controlling said recording means to record the updated management information in the second area of the disk-like recording medium.

13. An apparatus according to claim 12, wherein the information signal contains a motion image signal having a plurality of frames, and said state detecting means detects a degree of change between images of said plurality of frames.

14. An apparatus according to claim 13, wherein said control means outputs a timing signal when the change amount between the images of said plurality of frames exceeds a predetermined value, and controls said updating means and said recording means in accordance with the timing signal.

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15. An apparatus according to claim 14, wherein said recording means intermittently records the motion

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said recording means intermittently records the audio  
signal on the disk-like recording medium, and said  
control means so controls said recording means as to  
record the management information during a recording  
5 stop period of the audio signal in accordance with the  
timing signal.

20. An apparatus according to claim 12, wherein a  
recording data rate of said recording means is higher  
10 than a data rate of an information signal encoded by  
said encoding means.

21. A recording apparatus for recording a motion  
image signal and management information pertaining to a  
15 recording address of the motion image signal on a  
disk-like recording medium having a first area for the  
motion image signal and a second area for the  
management information,

wherein a change between pictures of an input  
20 motion image signal is detected, and the management  
information is recorded in the second area of the  
disk-like recording medium when the change between the  
pictures is detected during recording of the motion  
image signal.

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22. An apparatus for recording an image signal and  
management information pertaining to a recording

address of the image signal on a disk-like recording medium having a first area for the image signal and a second area for the management information, comprising:

storage means for storing the management information;

recording means for recording a motion image signal and a still image signal in the first area of the disk-like recording medium and recording the management information in the second area; and

control means for controlling said recording means to record the management information in the second area of the disk-like recording medium in accordance with designation of still image recording which is provided during recording of a motion image signal.

23. An apparatus according to claim 22, wherein said control means records the management information in the second area of the disk-like recording medium in accordance with designation of stop of recording of a motion image signal.

24. An apparatus according to claim 22, further comprising updating means for updating contents of management information stored in said storage means in accordance with a recording operation of the image signal to said disk-like recording medium, and

wherein said control means so controls said

updating means as to update contents of the management information in accordance with designation of still image recording which is provided during recording of the motion image signal, and said recording means  
5 records the updated management information in the second area.

25. An apparatus according to claim 24, wherein  
said control means so controls said updating means as  
to update contents of the management information in  
accordance with designation of a stop of recording of a  
motion image signal.

ABSTRACT OF THE DISCLOSURE

A recording apparatus of this invention detects the state of management information, which pertains to a recording address of an image signal, and which is reproduced from a disk-like recording medium having a first area for the image signal and a second area for the management information. On the basis of the detection result, management data is reproduced from the first area of the disk-like recording medium. On the basis of the management data reproduced from the first area, the management information reproduced from the second area is modified. A modify unit records the modified management information in the second area.

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FIG. 1

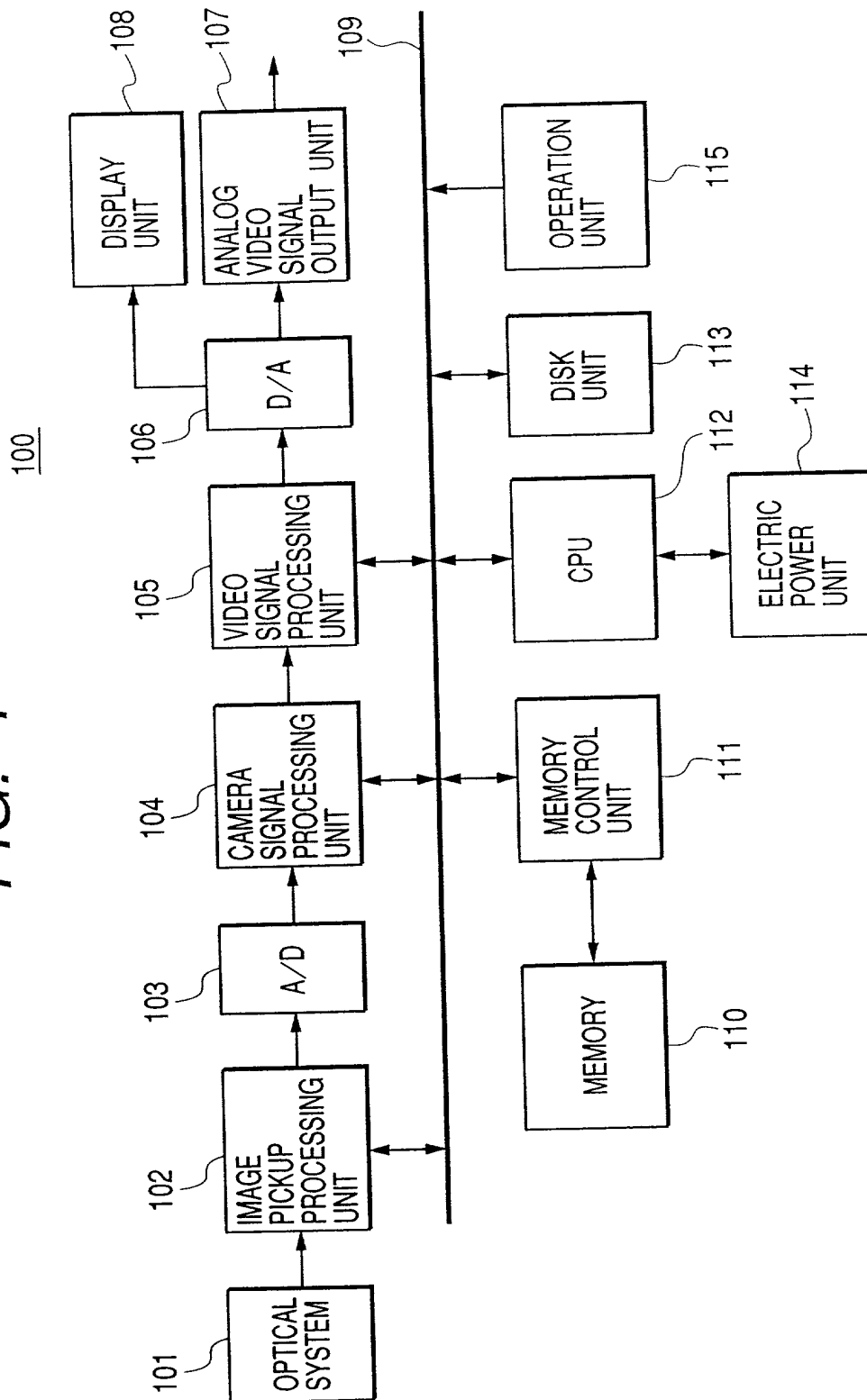


FIG. 2

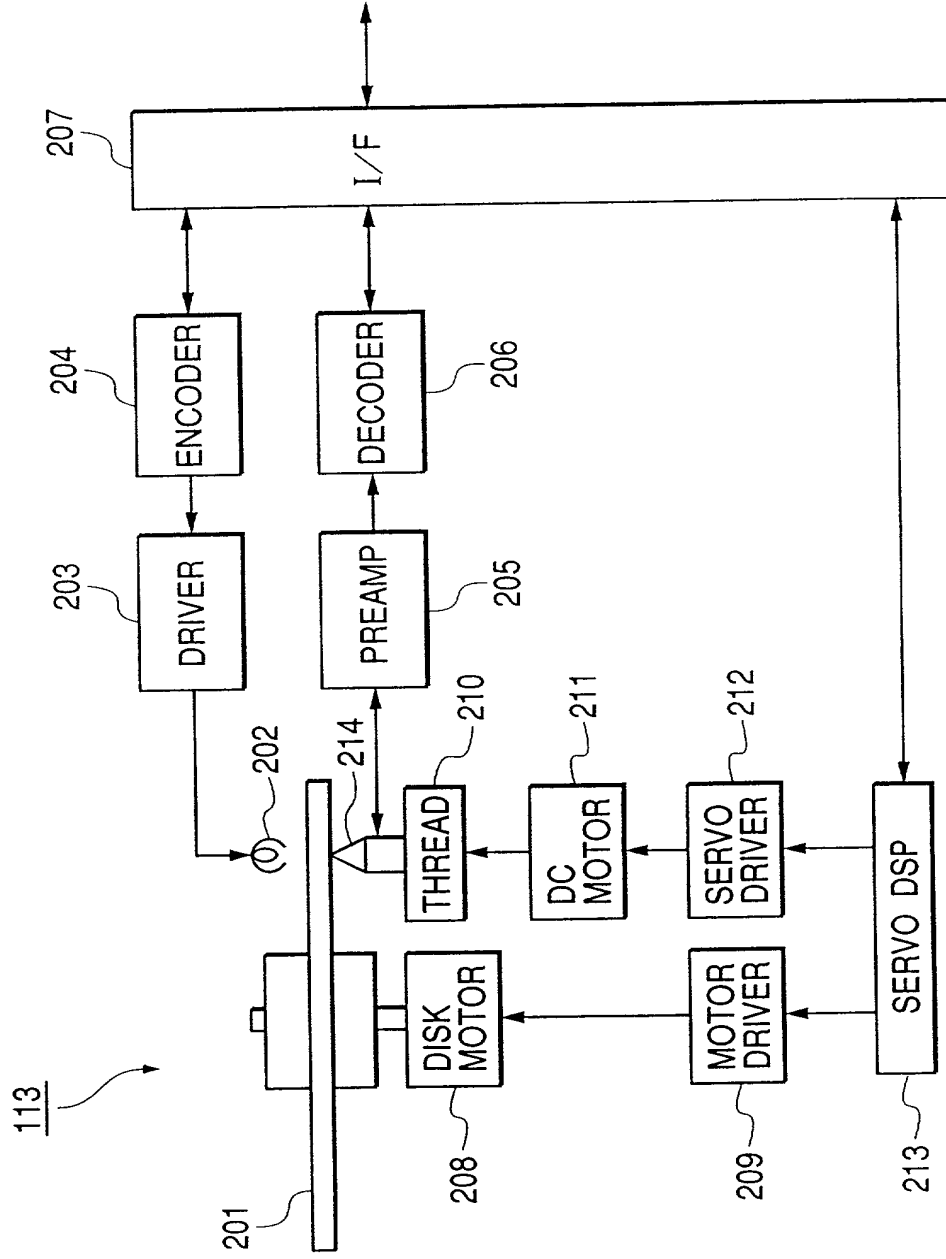


FIG. 3

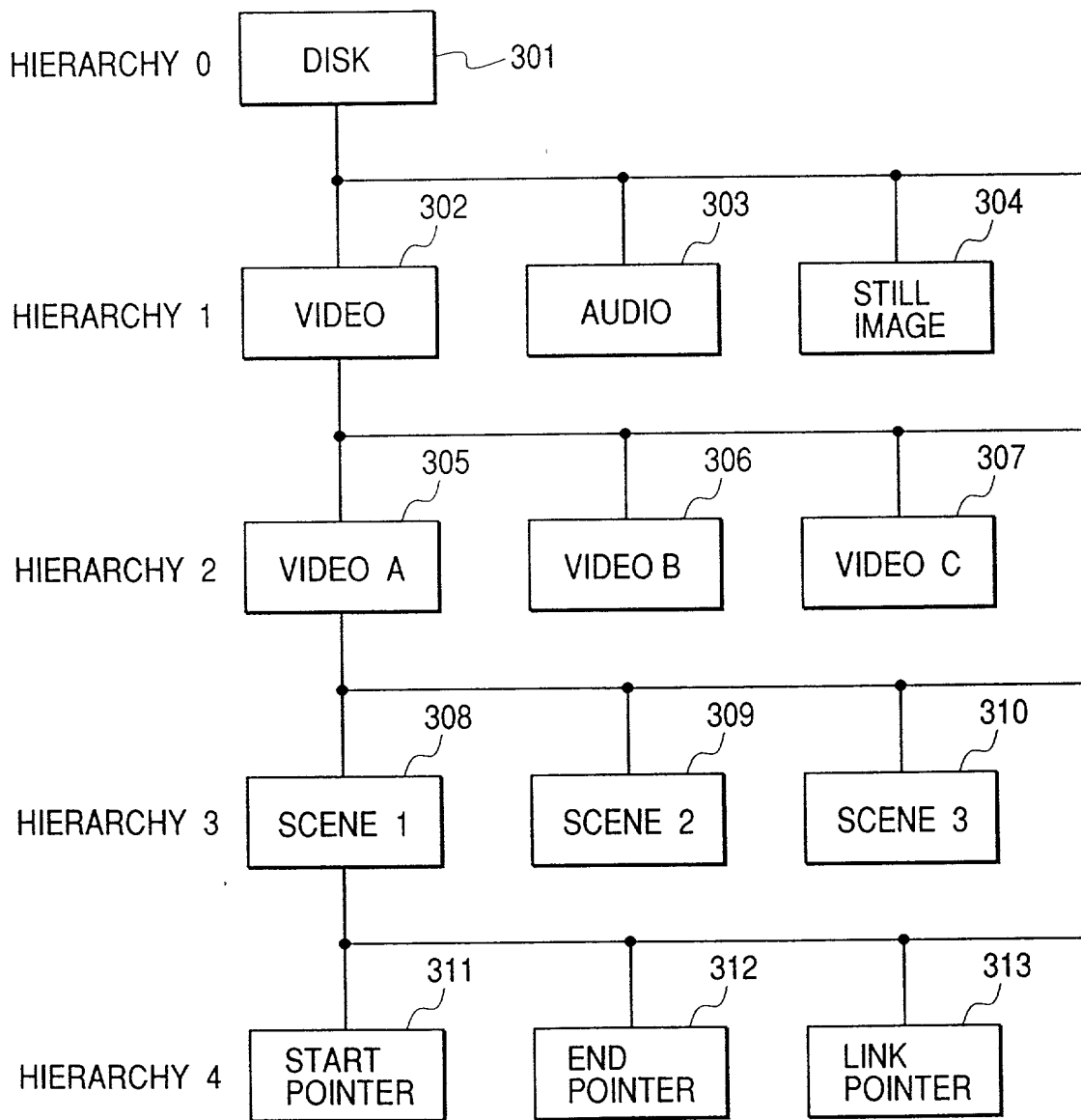






FIG. 5

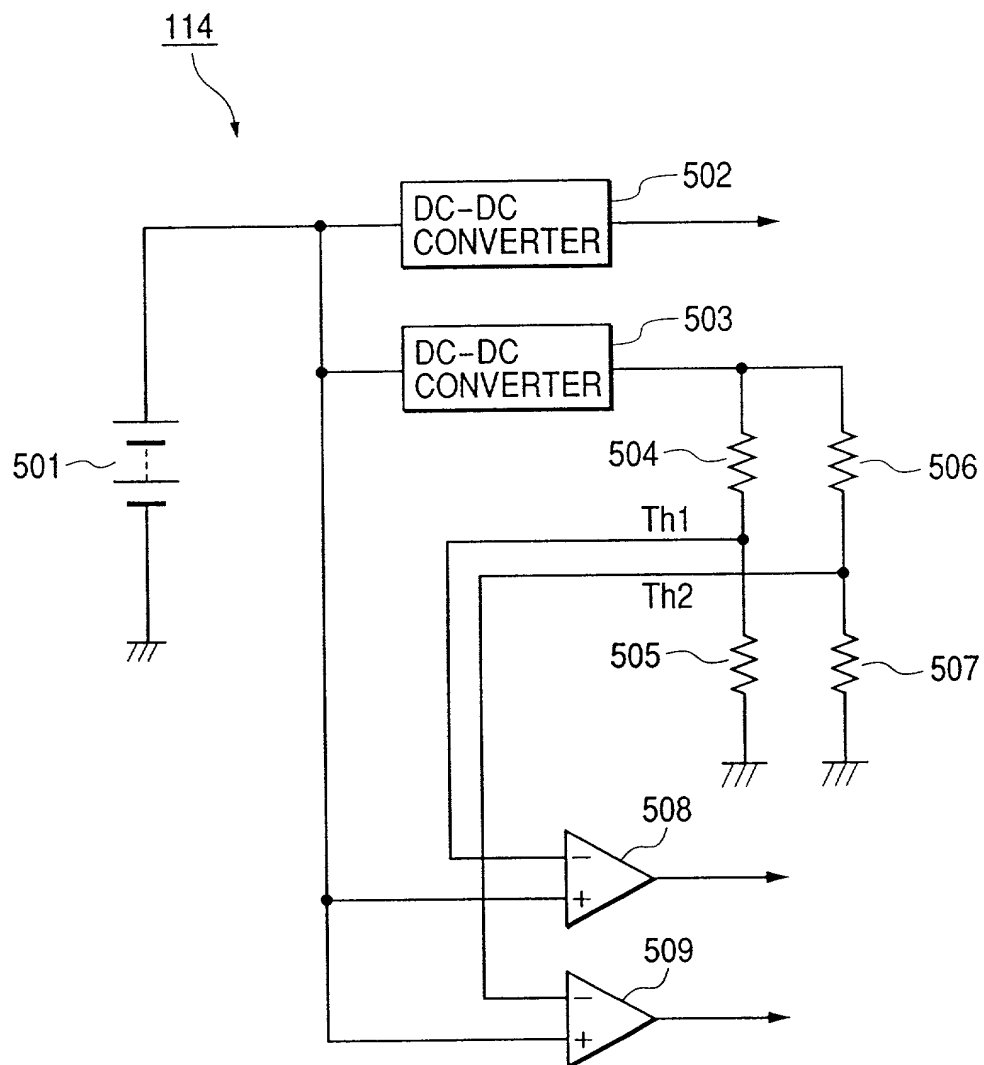
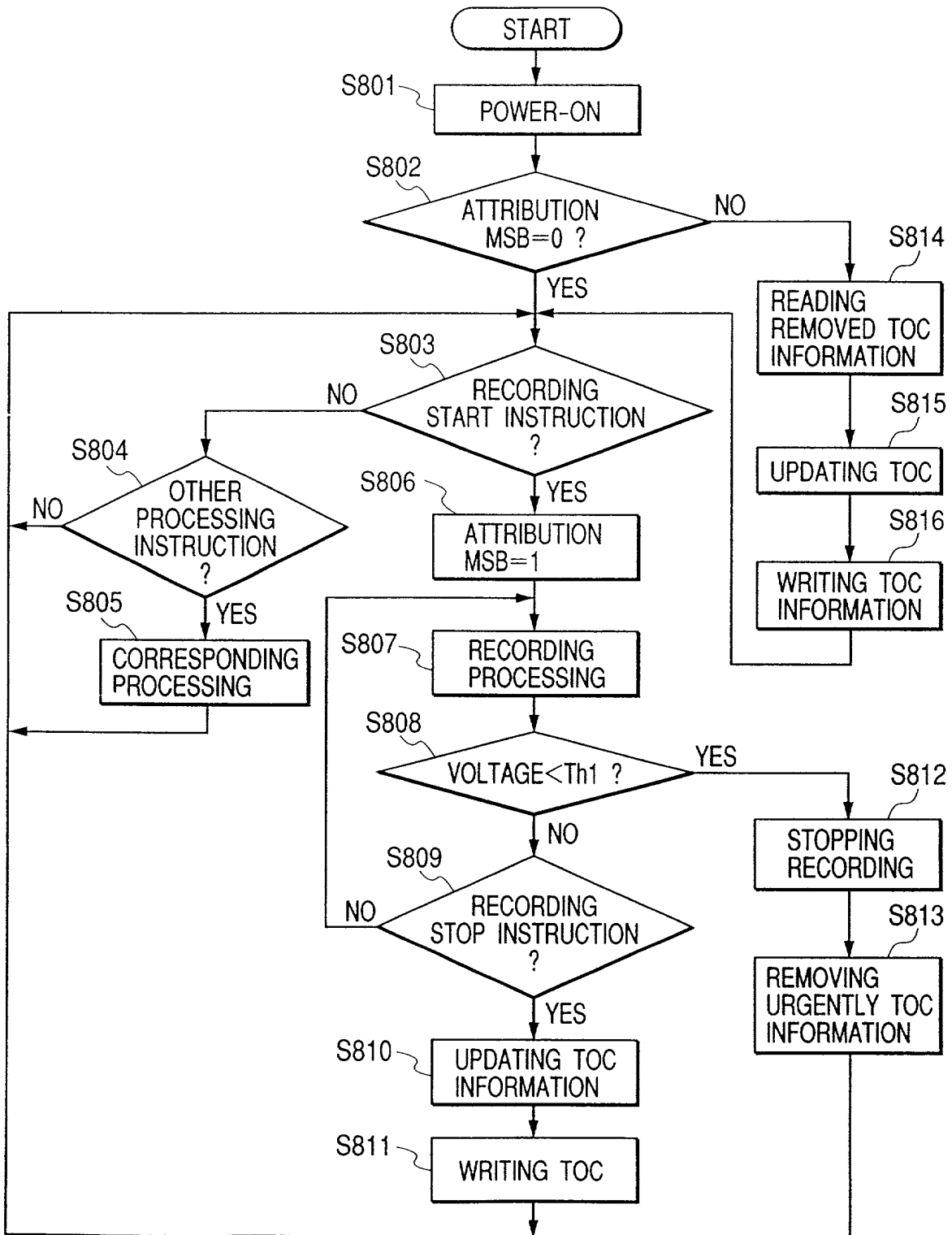






FIG. 8



*FIG. 9*

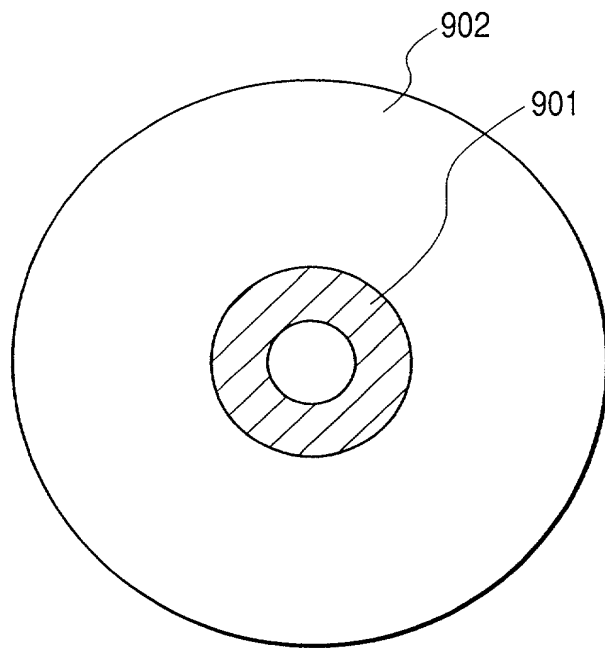


FIG. 10

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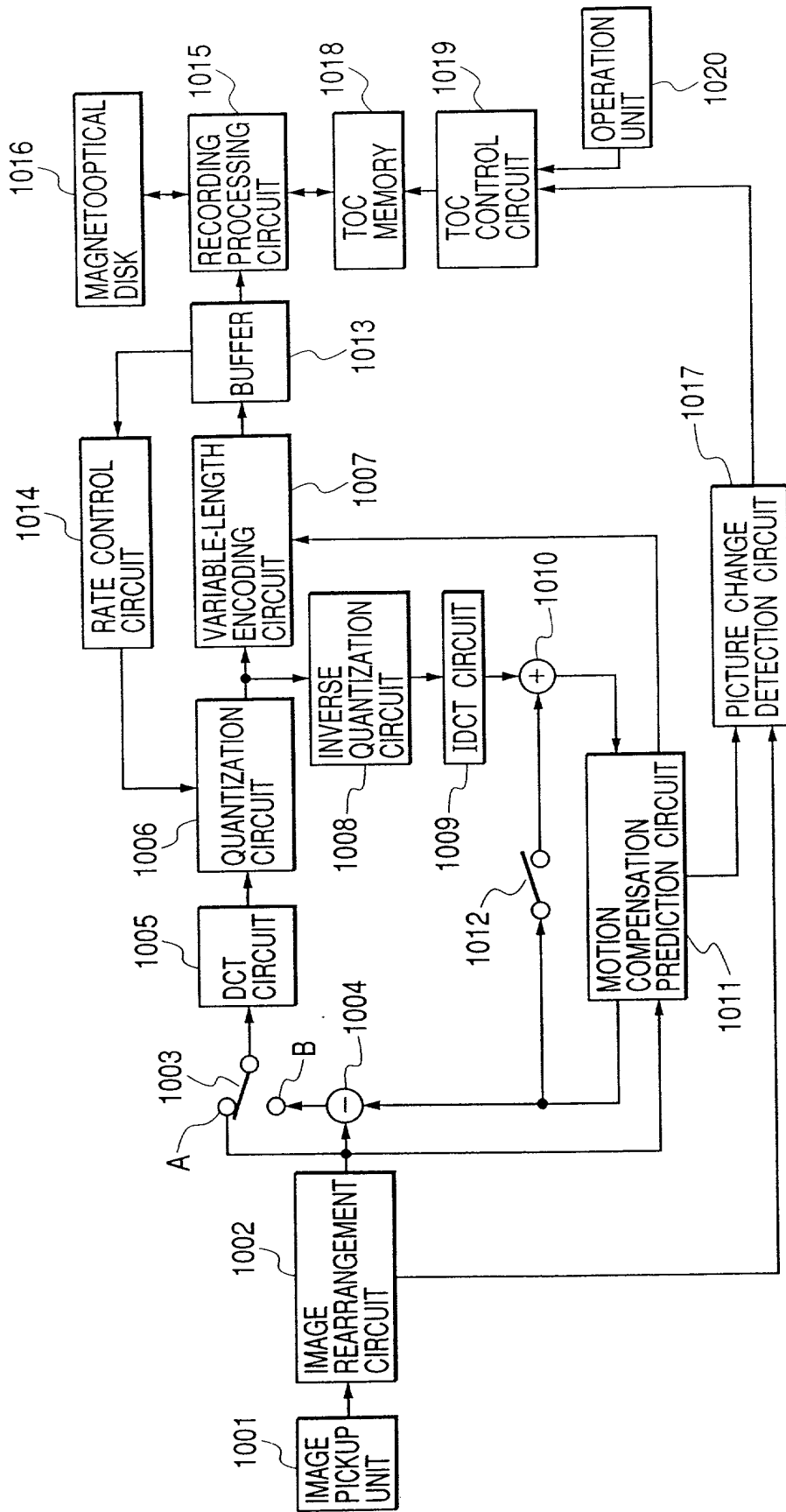


FIG. 11

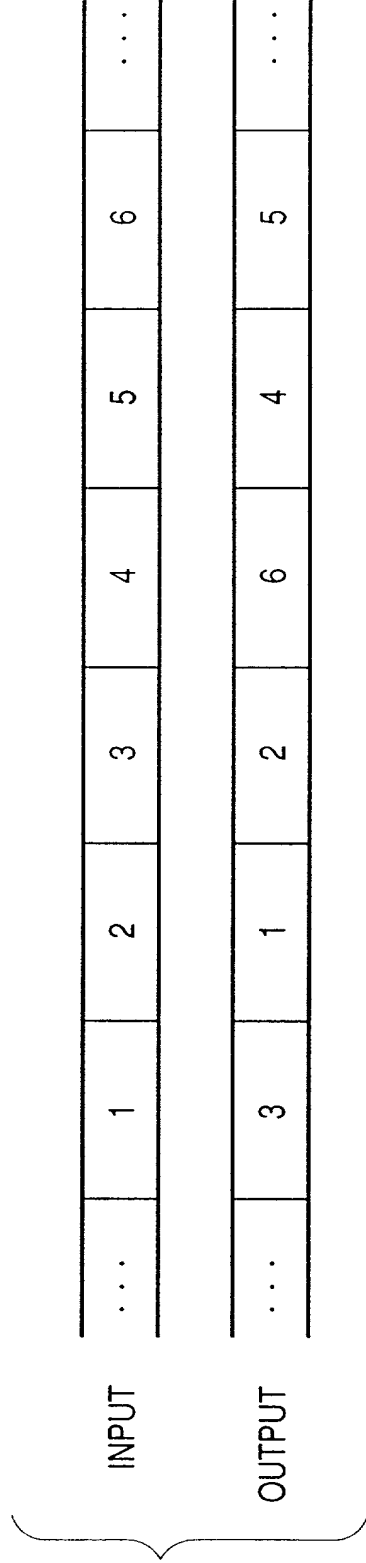


FIG. 12

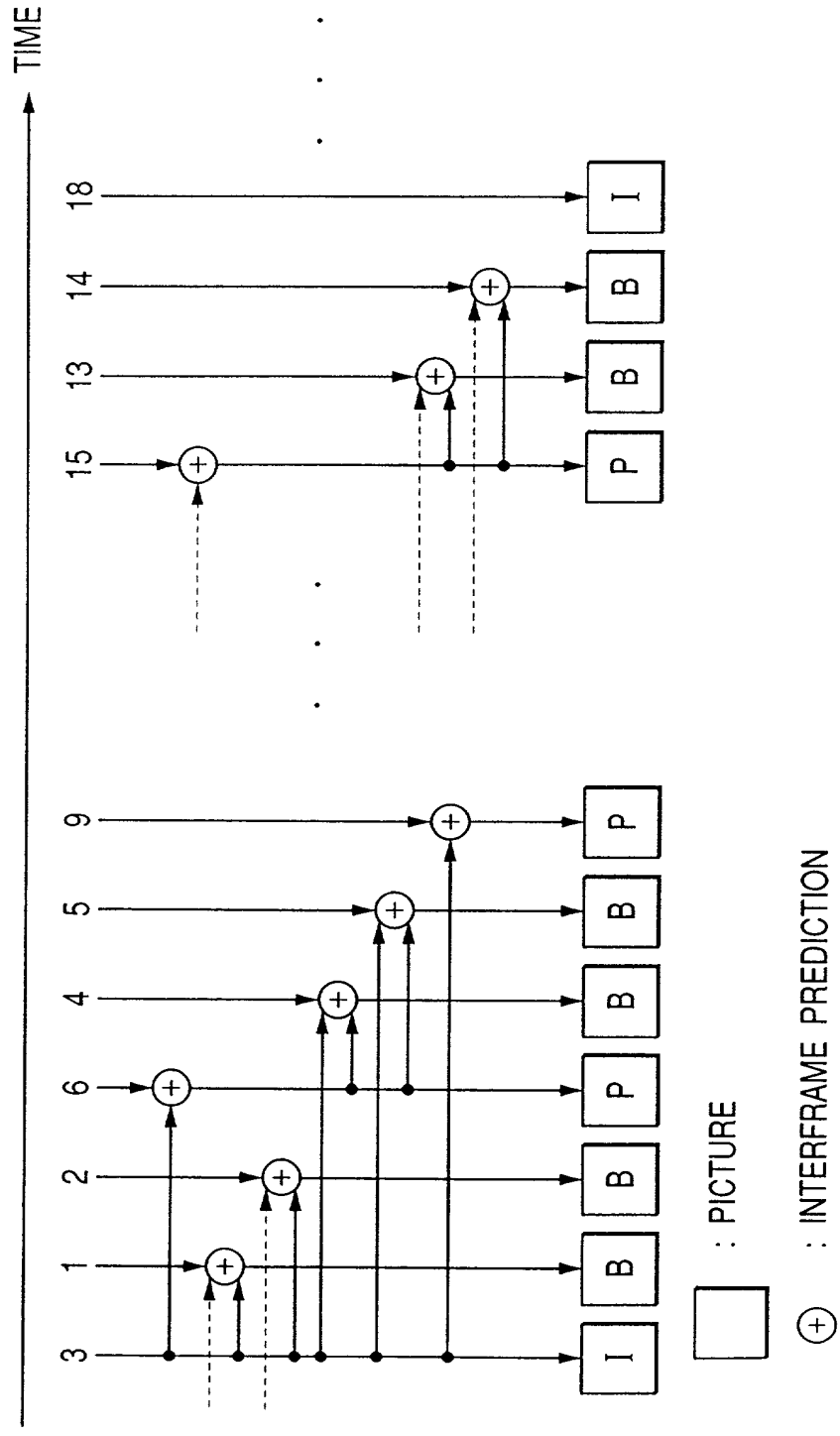






FIG. 15A

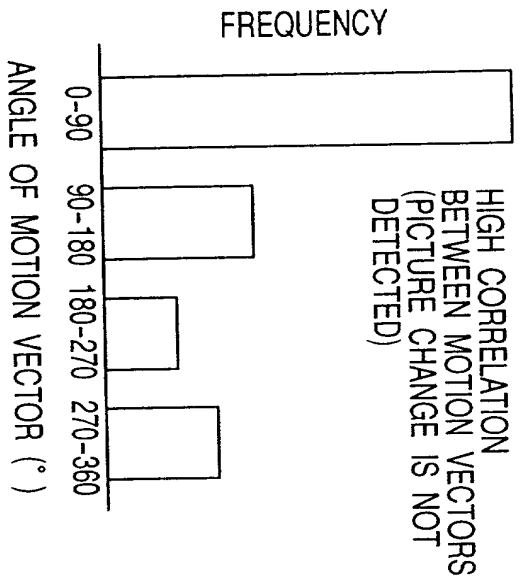


FIG. 15B

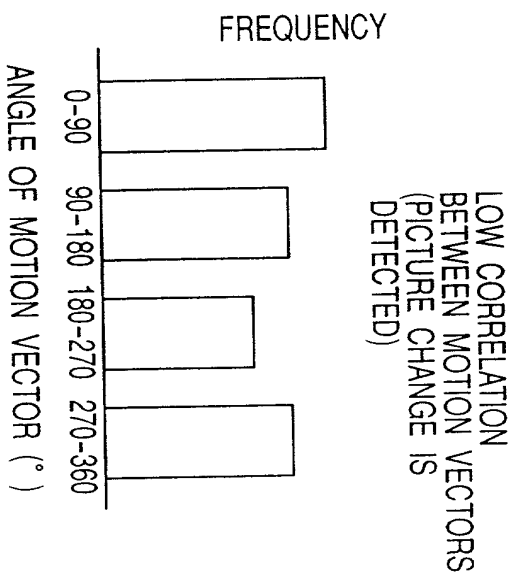


FIG. 16

1000

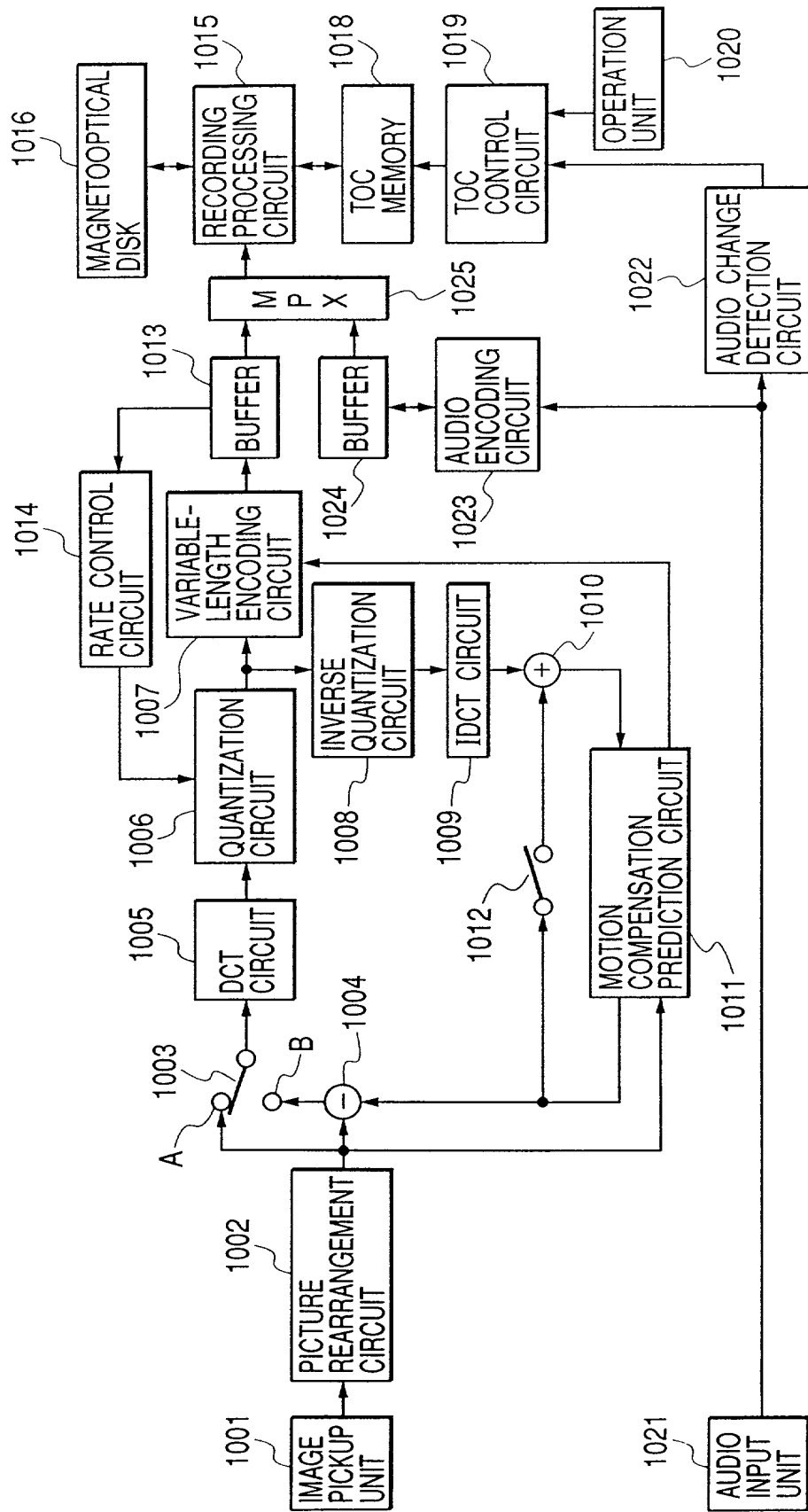


FIG. 17

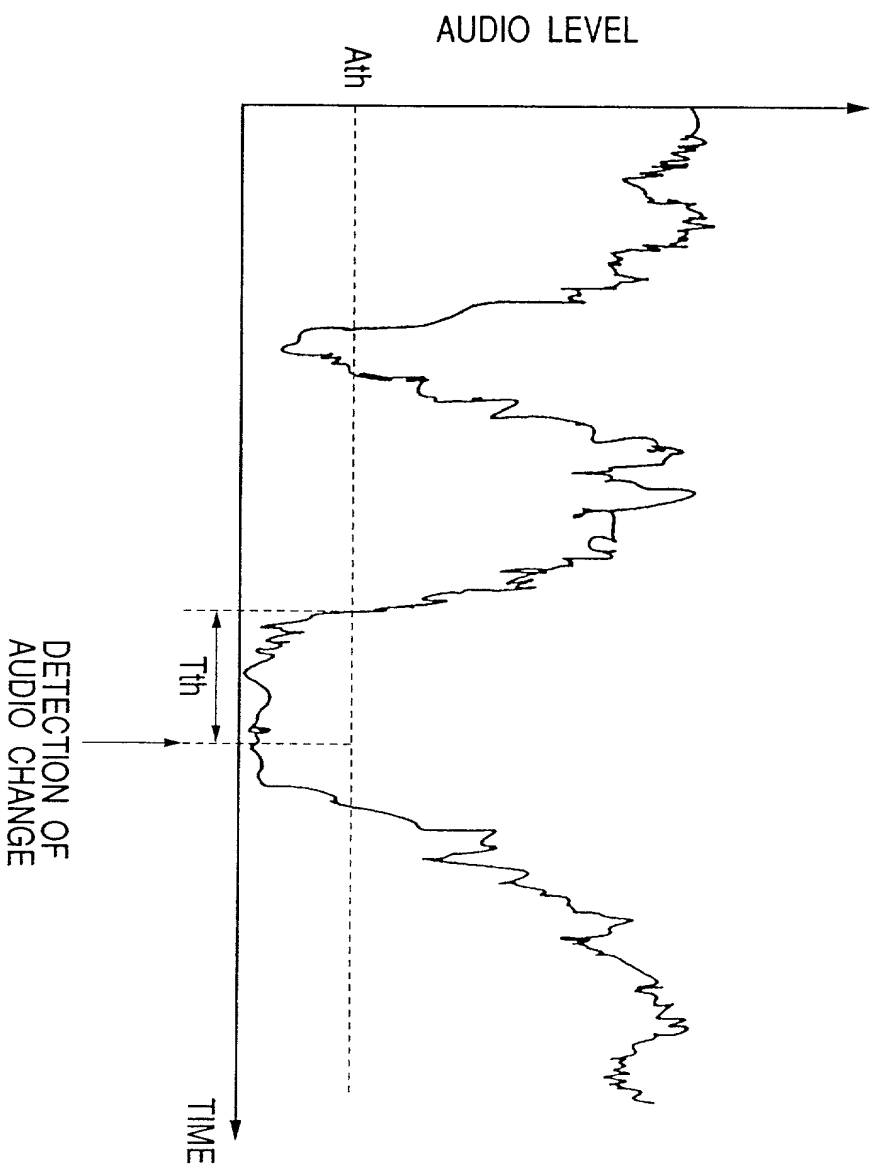
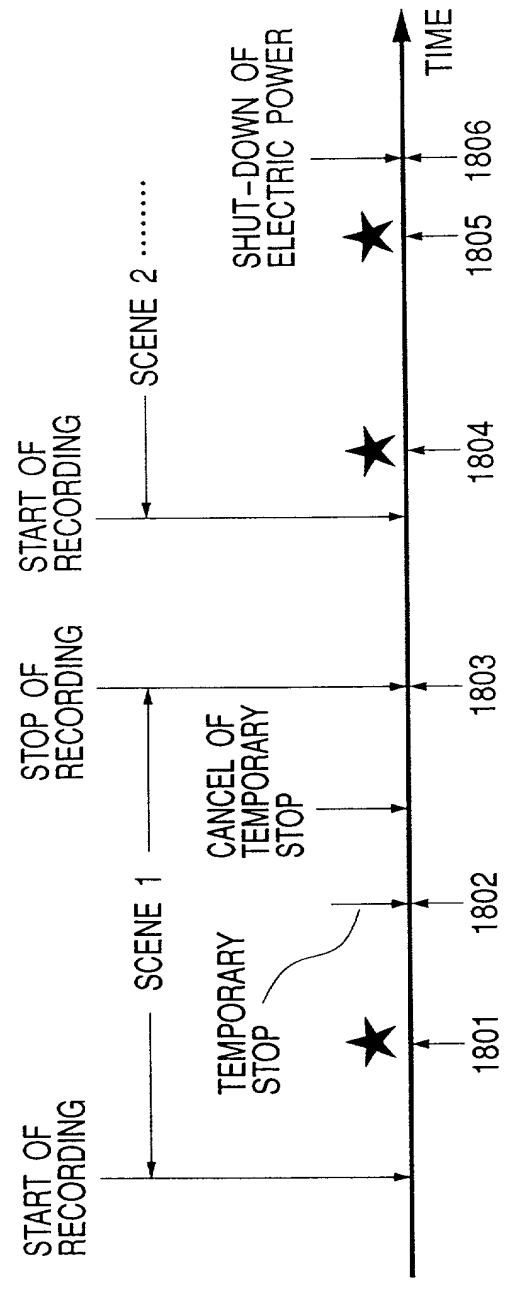


FIG. 18



**FIG. 19**

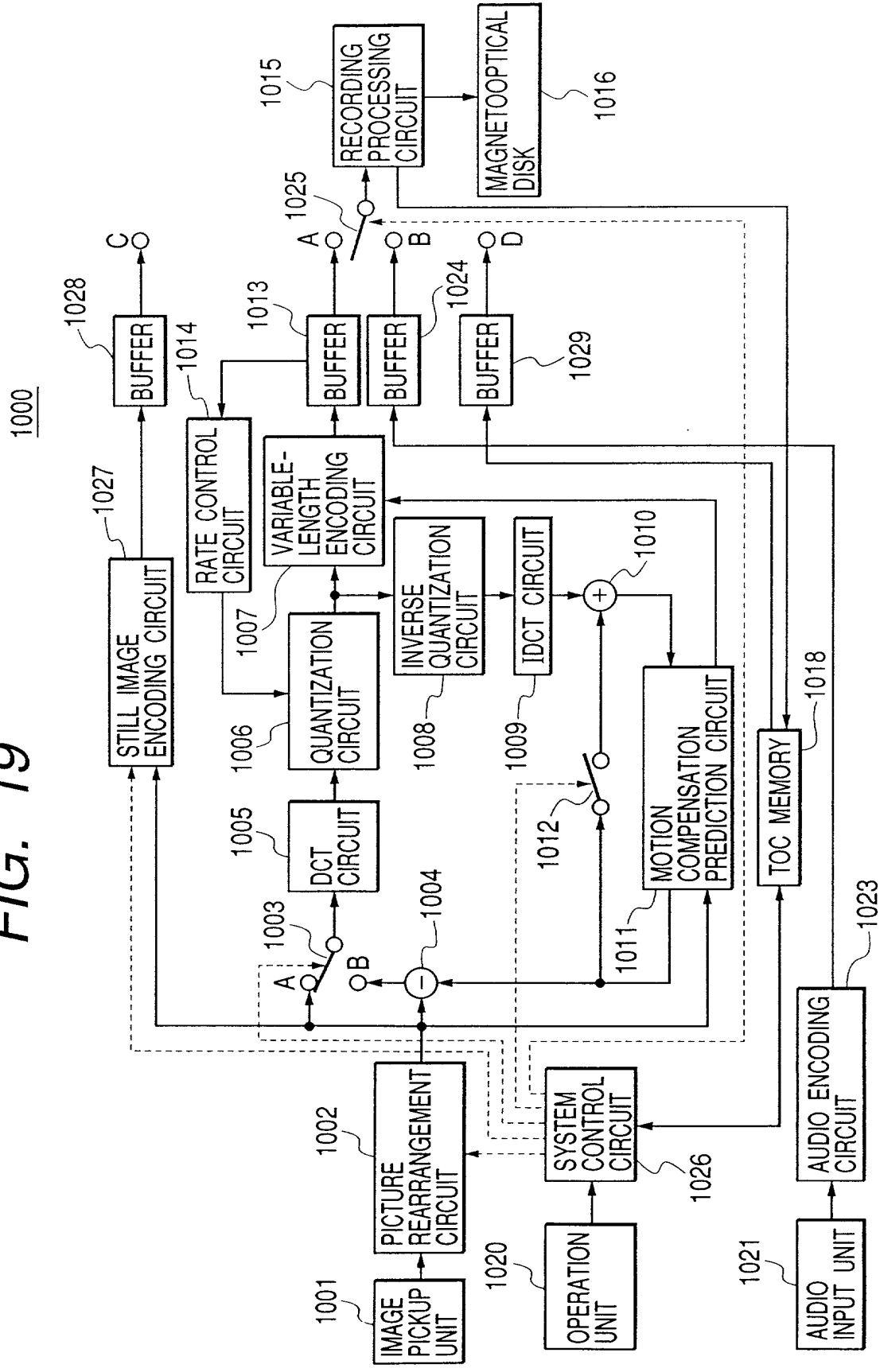


FIG. 20

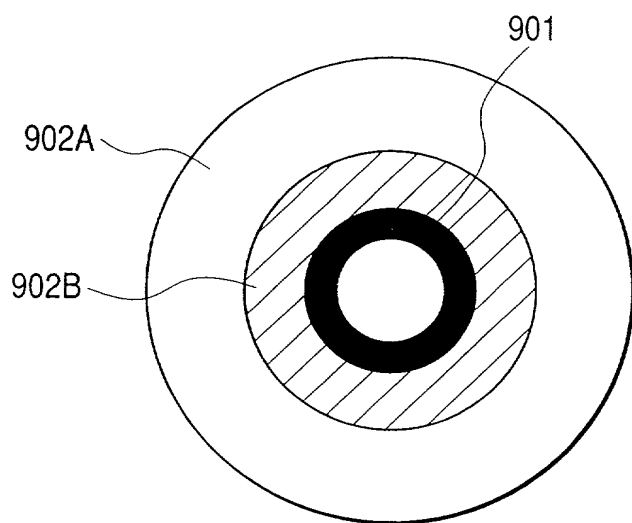


FIG. 21

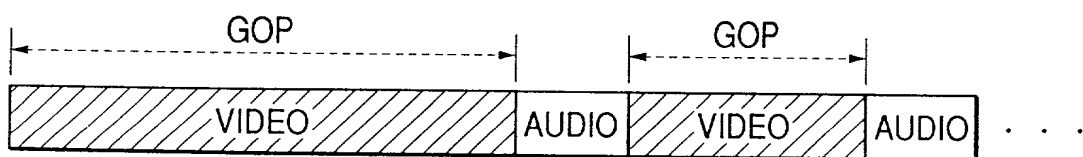


FIG. 22

